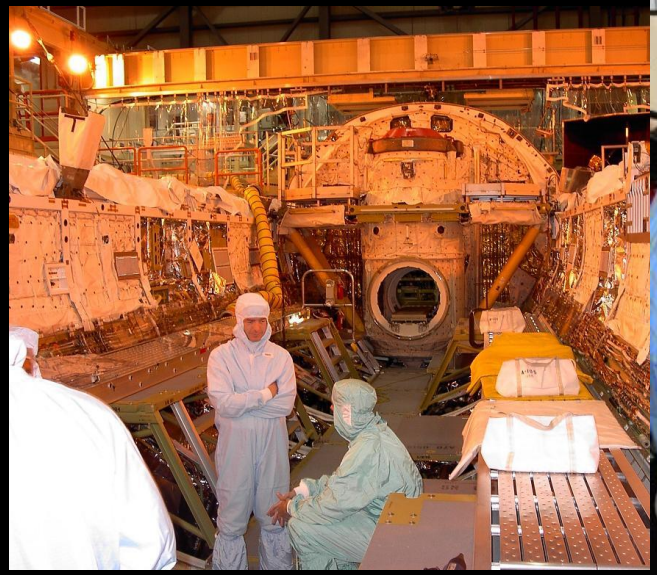
National Aeronautics and Space Administration

KENNEDY SPACE CENTER

PUSHING THE BOUNDARIES

Tracy Gill
NASA/KSC Technology Strategy Manager
Central Florida STEM Education Council Meeting June 16, 2017

NASA "Action" Shots



Deep Space Habitats

Habitat Demonstration Unit (2011-2013)

Multi-Purpose Logistics Module: Donatello
– to be used in NextSTEP Habitat project

KSC's Vision

KSC is the world's preeminent launch complex for government and commercial space access, enabling the world to explore and work in space.

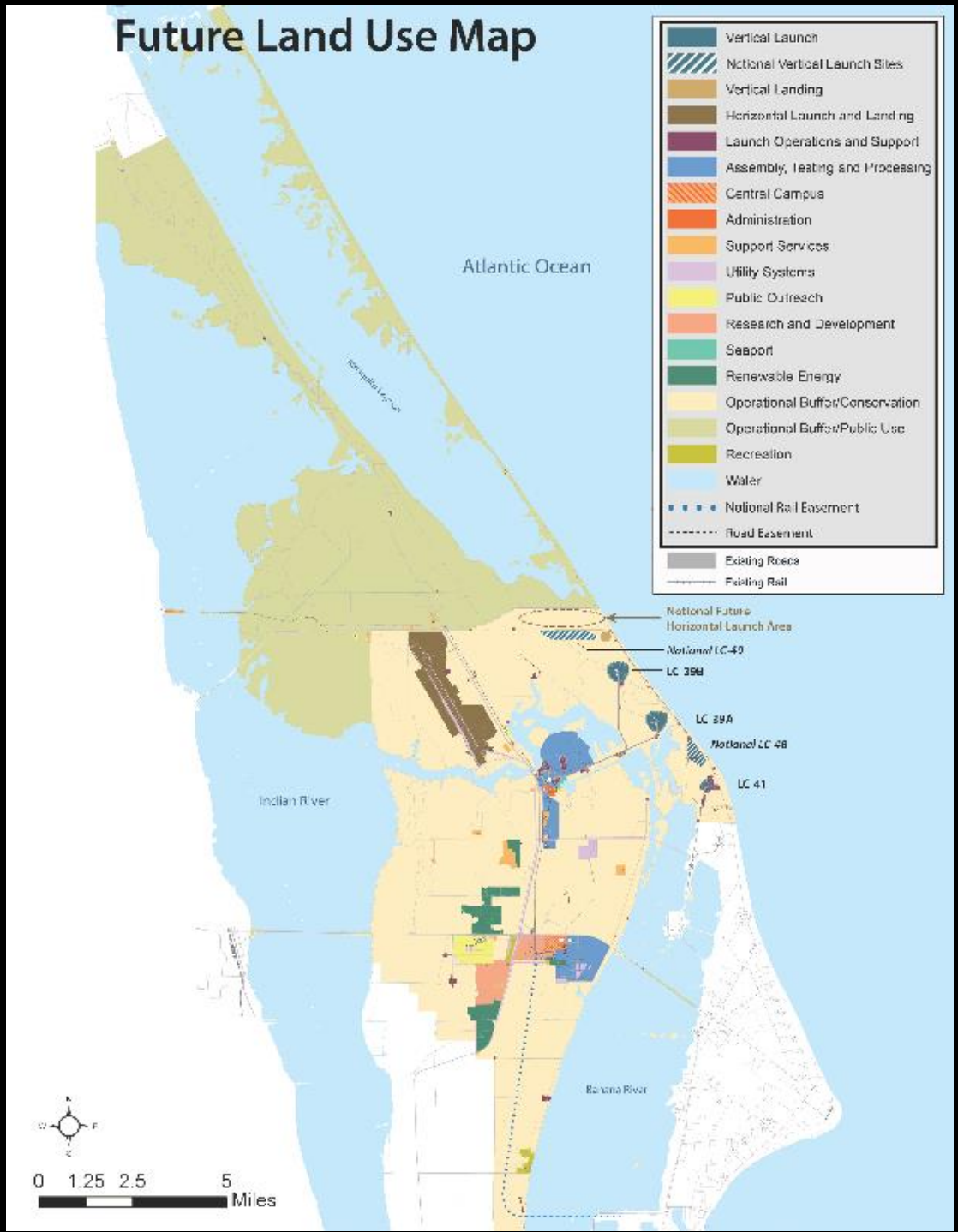
Spaceport Evolution at KSC

Timeframe	Theme
Pre-2012	Focused Support for NASA Programs
Near Term	Focused Support for Continuing NASA Programs with Emerging Commercial Integration; Economic Sustainability
Long Term	Continuing Support for NASA Programs with Balanced Commercial Integration
Future: Beyond 2032	Continued Support for NASA Programs; Fully Leverage All Assets and Land Area Resources; Optimized Diversified Commercial Integration

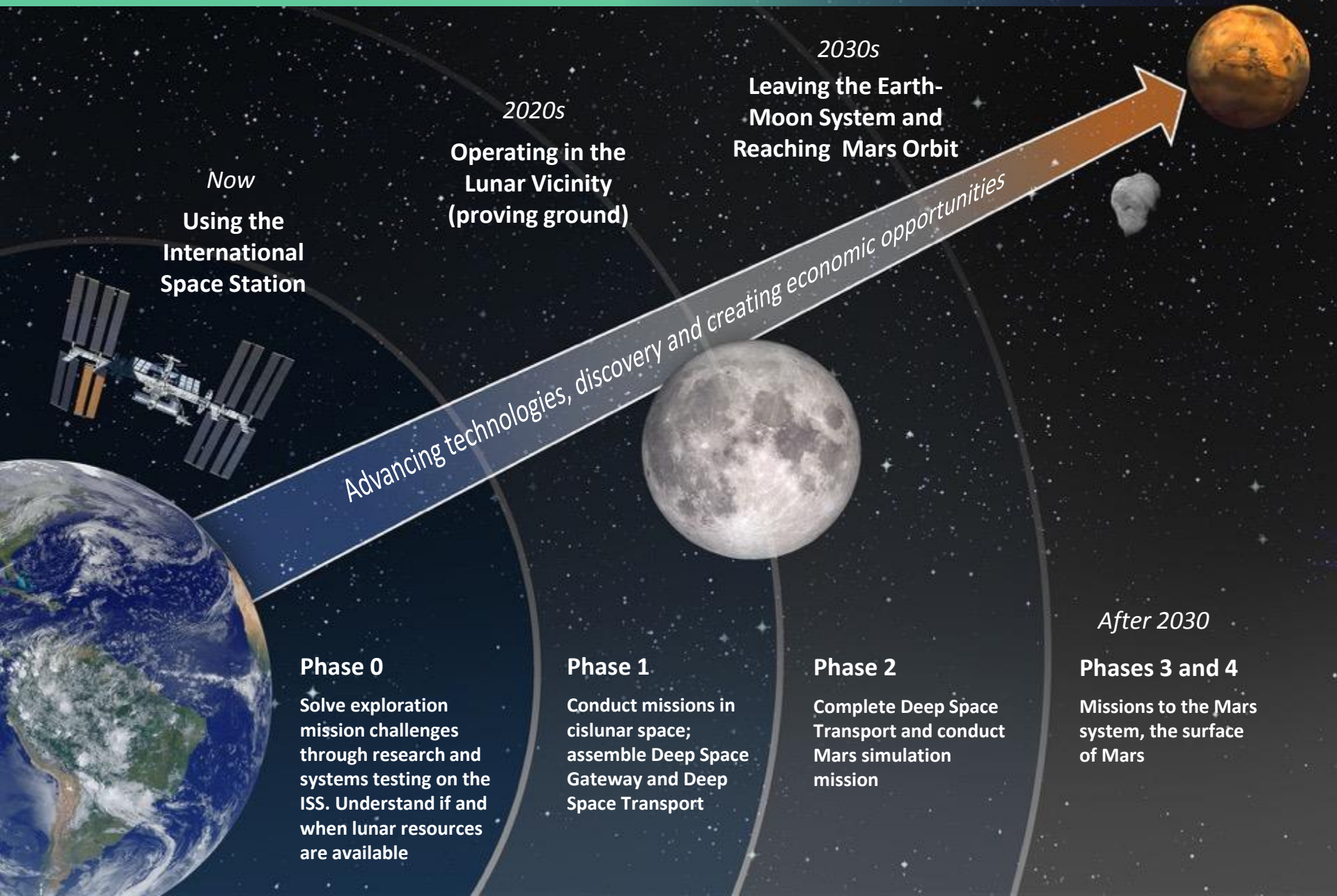
Spaceport models like Kennedy Space Center are changing toward airport-like operations which includes government and commercial interests

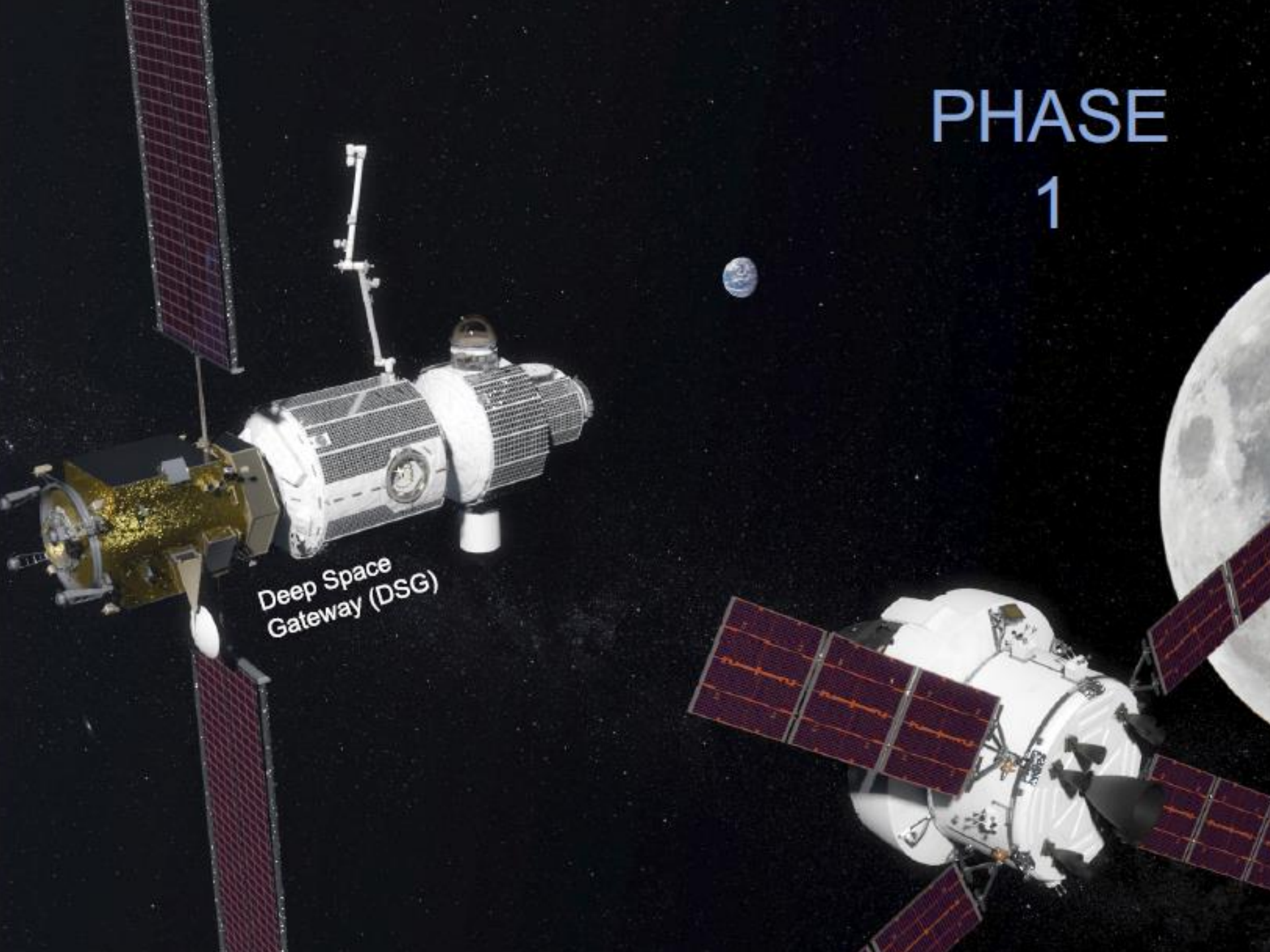
Spaceports are getting planned by architects and city planners for these multiple interests Areas include:

- Administrative Areas
- Transportation
- Recreation
- Utilities
- Public Outreach
- Central Campus
- Horizontal and Vertical Launch and Landing Facilities
- Operational Buffers
- Notional Growth Areas Identified



Exploring Space In Partnership



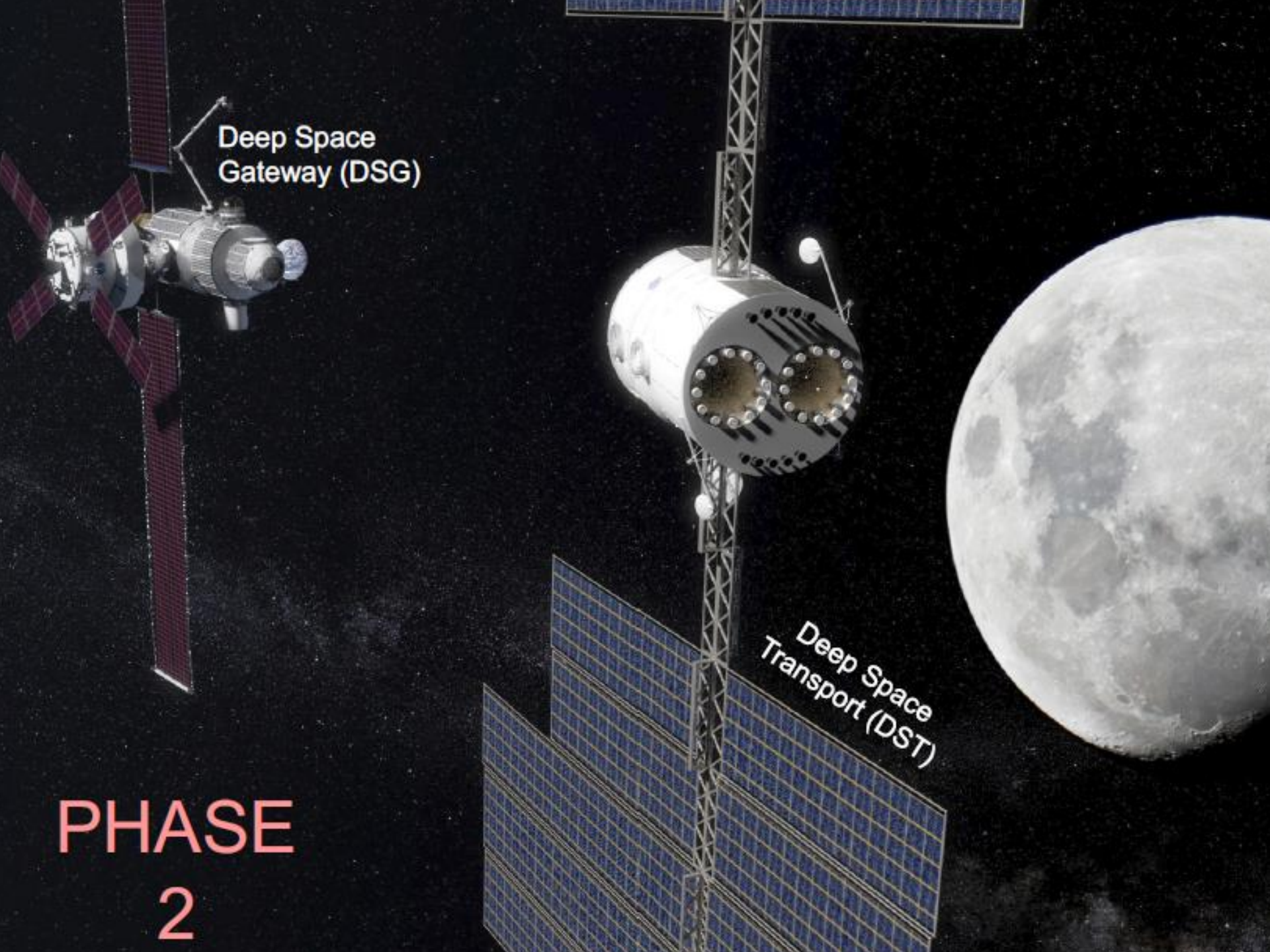

PHASE
1
Deep Space
Gateway (DSG)

Deep Space Gateway Functionality

- **Assumptions**
  - Deep Space Gateway provides ability to support multiple NASA, U.S. commercial, and international partner objectives in Phase 1 and beyond
  - The Gateway is designed for deep space environments
    - Supports (with Orion docked) crew of 4 for total mission up to 42 days
    - Supports buildup of the Deep Space Transport
    - Open trade for compatibility for operations in Low Lunar Orbit

- **Emphasis on defining early Phase 1 elements**
  - Gateway Power Propulsion Bus
  - Gateway Habitat
  - Logistics Strategy

- **Future work to refine later elements; early feasibility trades complete**
  - Airlock
  - Deep Space Transport


Deep Space
Gateway (DSG)
Deep Space
Transport (DST)
PHASE
2

Deep Space Transport Functionality

- **Assumptions**
  - Deep Space Transport provides habitation and transportation needs for transporting crew into deep space including supporting human Mars-class missions
  - The Transport system life will be designed for:
    - Reused for 3 Mars-class missions with resupply and minimal maintenance
    - Crew of 4 for 1,000 day-class missions in deep space
    - Launched on one SLS 1B cargo vehicle - resupply and minimal outfitting to be performed in cislunar space

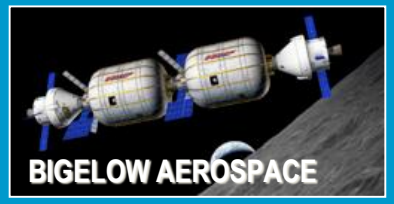
- **Emphasis on supporting shakedown cruise by 2029**
  - Shakedown cruise to be performed in lunar vicinity
  - Utilizes deep space interfaces and common design standards

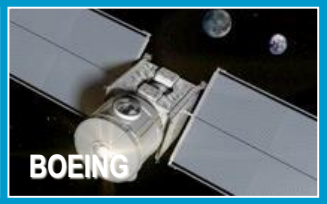
- **Future work trades**
  - Shakedown cruise objectives
  - Mars reference mission functional requirements

NextSTEP Habitation Overview

NextSTEP Phase 1: 2015-2016

Cislunar habitation concepts that leverage commercialization plans for LEO



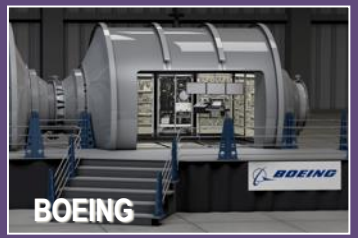


FOUR SIGNIFICANTLY DIFFERENT CONCEPTS RECEIVED

Partners develop required deliverables, including concept descriptions with concept of operations, NextSTEP Phase 2 proposals, and statements of work.

NextSTEP Phase 2: 2016-2018

FIVE GROUND PROTOTYPES BY 2018



- Partners refine concepts and develop ground prototypes.
- NASA leads standards and common interfaces development.

ONE CONCEPT STUDY

Initial discussions with international partners

Define reference habitat architecture in preparation for Phase 3.

Phase 3: 2018+

- Partnership and Acquisition approach, leveraging domestic and international capabilities
- Development of deep space habitation capabilities
- Deliverables: flight unit(s)

How are we leading future human exploration?

- Maximizing utilization of the International Space Station
- Actively promoting LEO commercialization
- Resolving the human health and performance challenges
- Expanding partnerships with commercial industry
- Growing international partnerships
- Building the critical *Deep Space Infrastructure*
- Enabling the capabilities to explore multiple destinations

NASA Explores

Mars

Resource Prospector (Coming soon)

Curiosity – Mars Science Laboratory

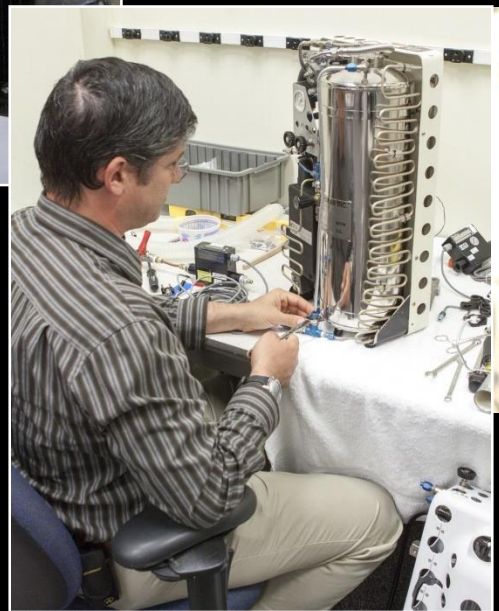
Moon

STEM EXAMPLES OF WORK AT KSC

Payload Processing

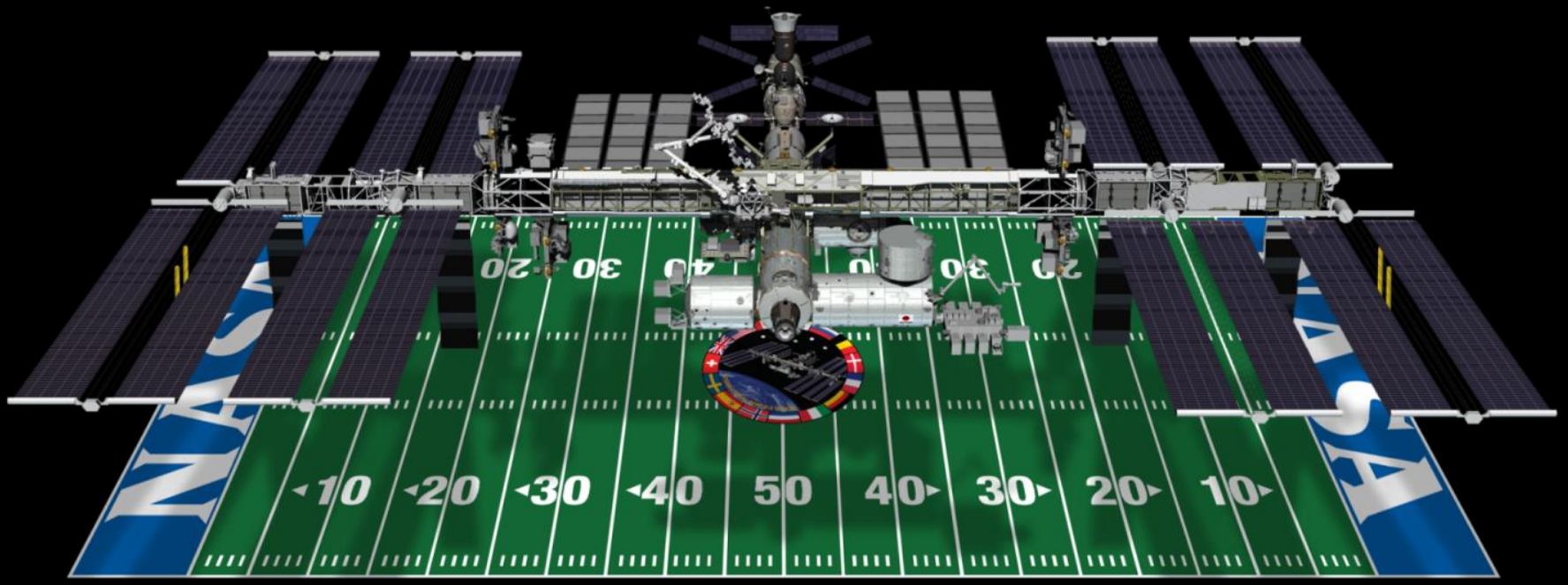
Research and Technology

Cryogenic Breathing Apparatus

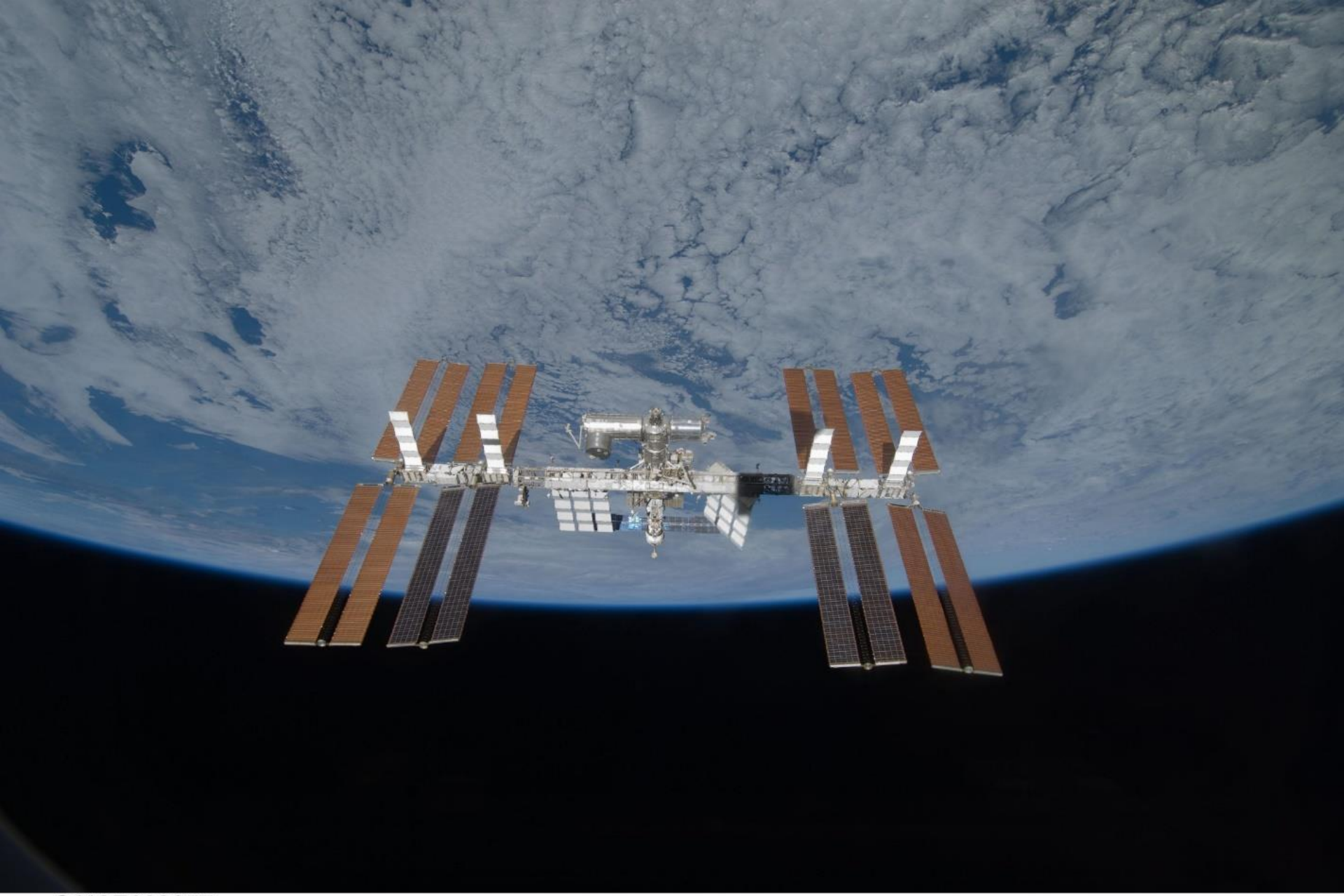


Integrated Display and Environmental Awareness System

International Space Station (ISS)



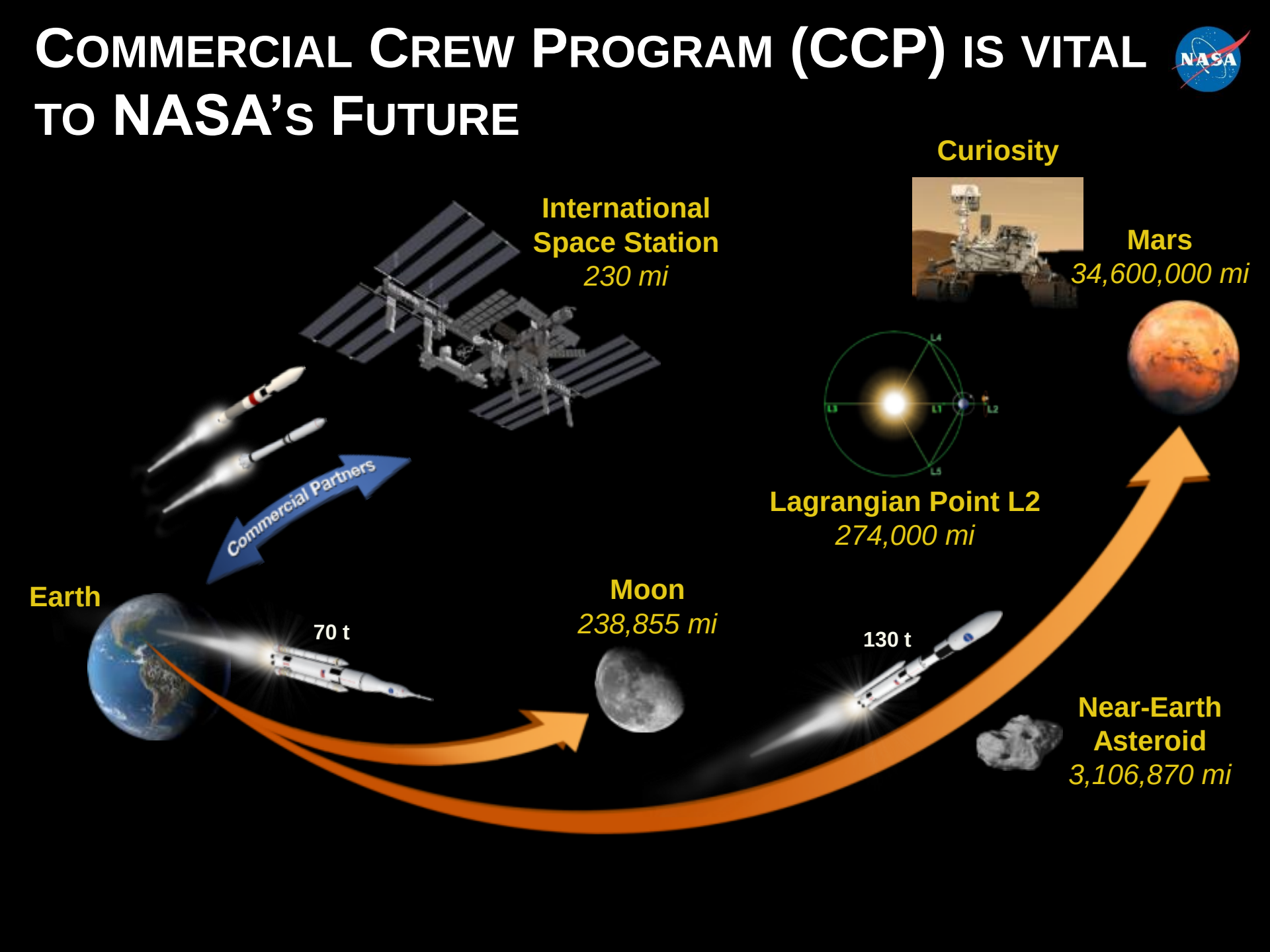
- Spacecraft Mass: +800,000 lb (+362,874 kg)
- Velocity: 17,500 mph (28,200 kph)
- Orbits: 16 times around the Earth/day (~every 90 minutes)
- Altitude: 220 miles above Earth
- Power: 80 kW continuous



S119E008357

See the ISS pass overhead your area! - https://spotthestation.nasa.gov/

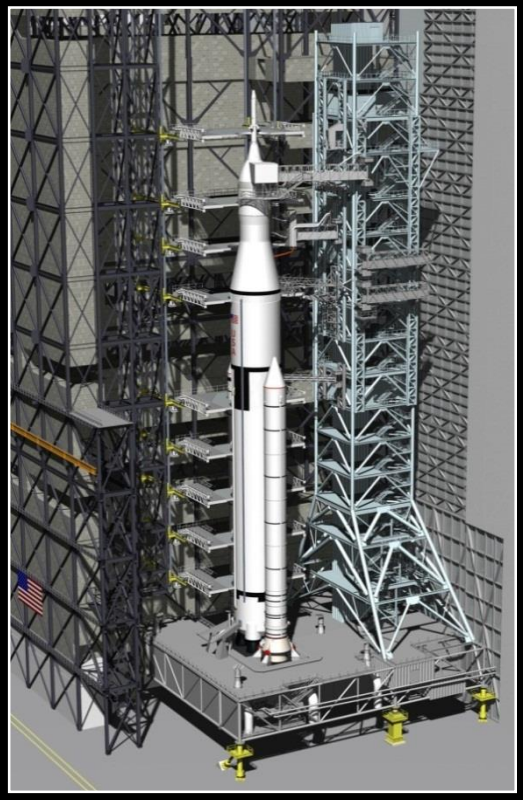
COMMERCIAL CREW PROGRAM (CCP) IS VITAL TO NASA'S FUTURE



The Future – Space Launch System/Orion

Orion

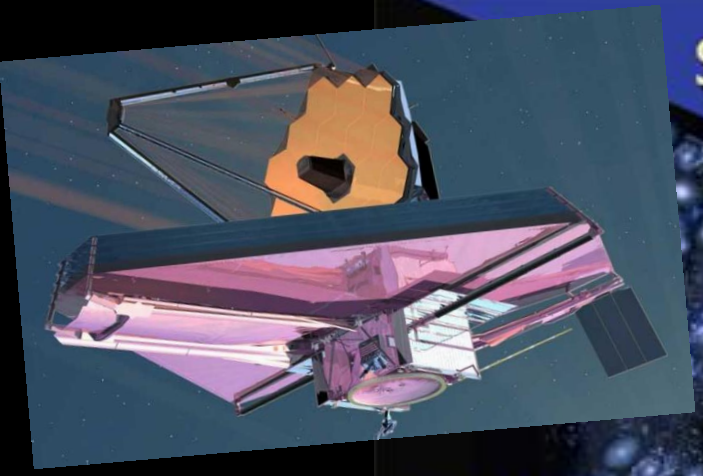
Updated Launch Control Room

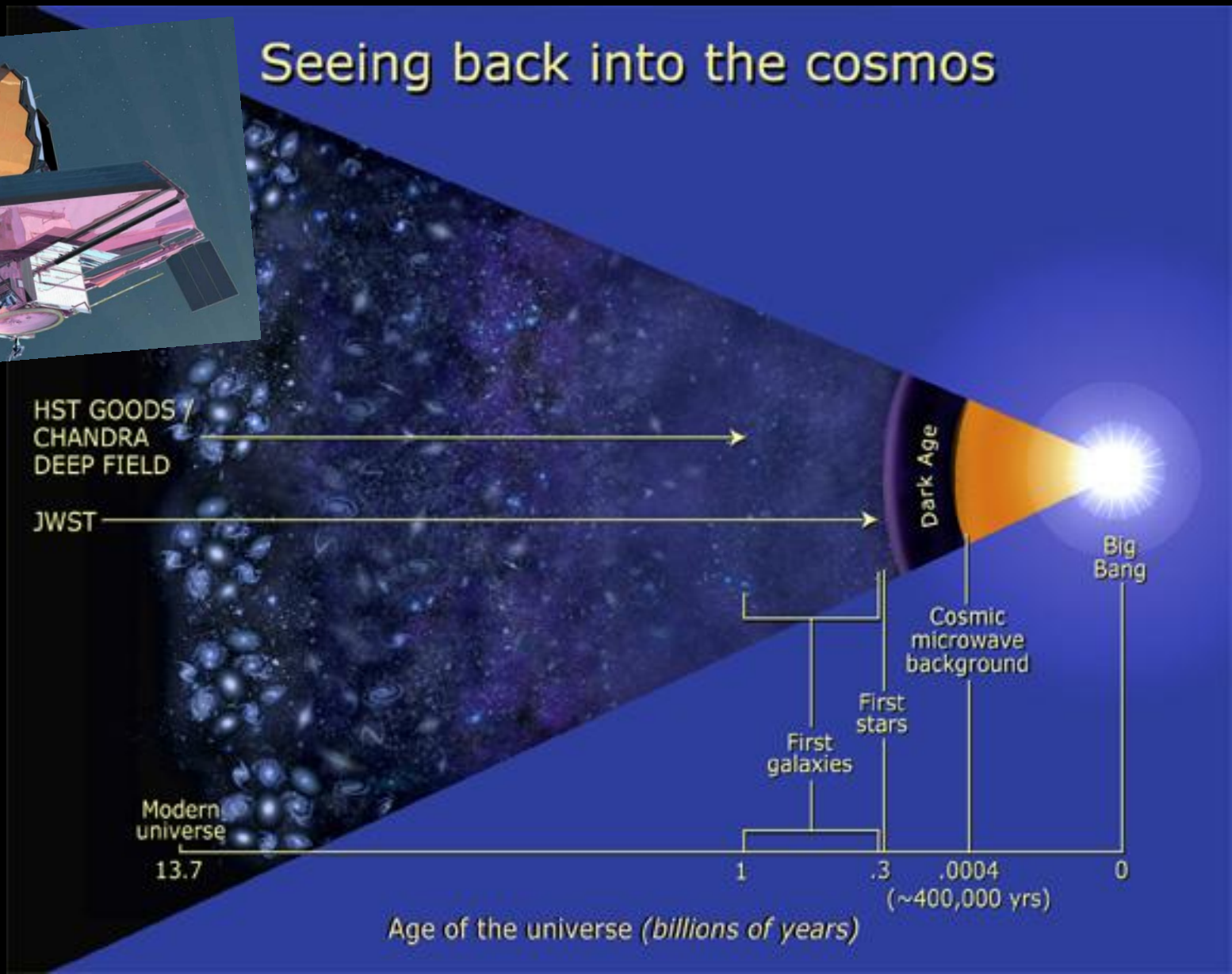


SLS on the mobile launcher

SLS on the mobile launcher at the launch pad

JAMES WEBB SPACE TELESCOPE (JWST)





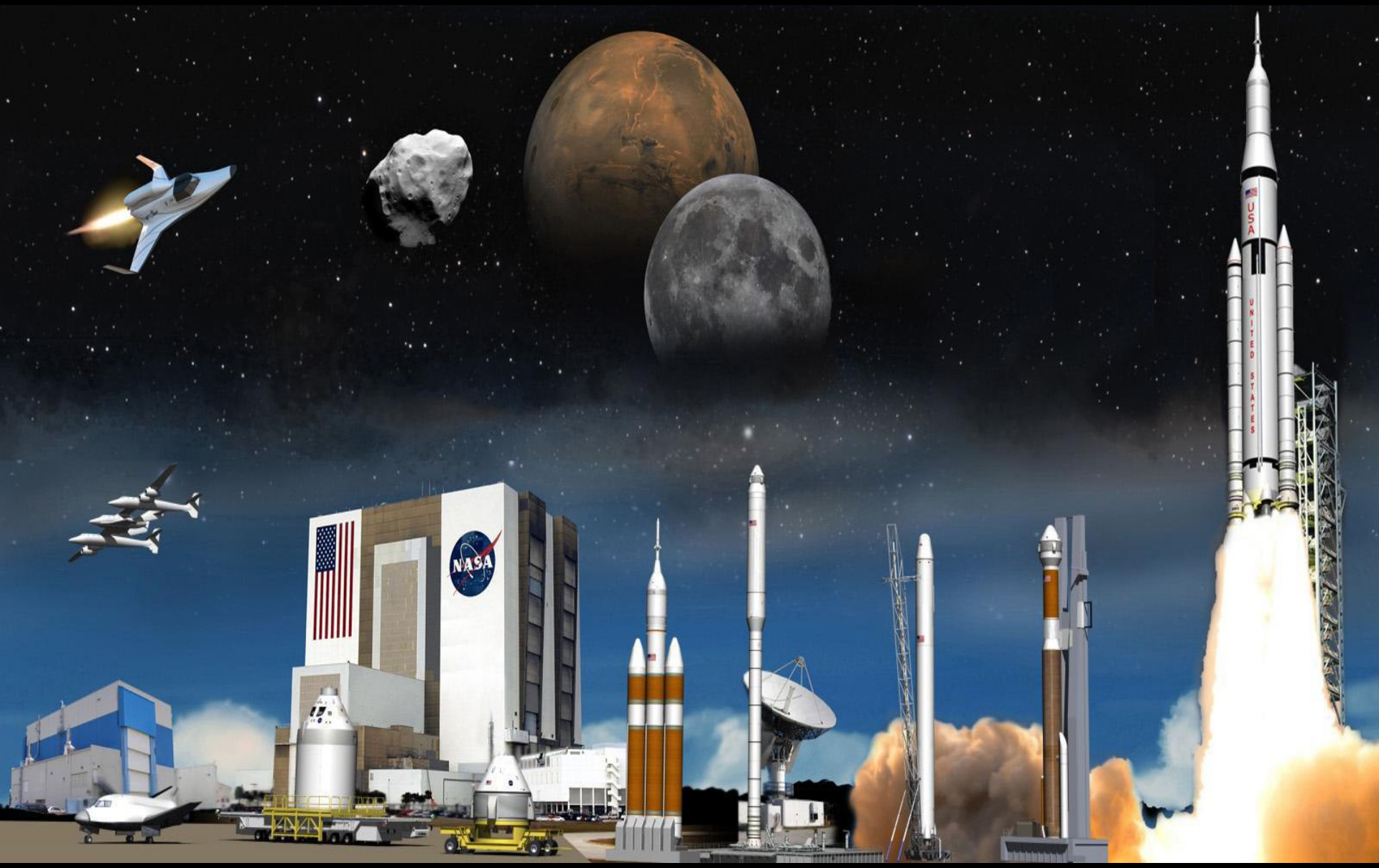
NASA Opportunities

- *60% of the jobs are Professional, Engineering, and Scientific –* **Aerospace Engineer**
- *24% are Administrative and Management –* **Public Affairs Specialist**
- *9% are Technical and Medical Support –* **Electronics Technician**
- *7% are Clerical and Administrative Support –* **Procurement Clerk**
- *Less than 1% are Trades and Labor -* **High Voltage Electrician**

What Should I Study?

The most important thing for preparing to find a job at NASA is that you study what you like and work hard to achieve your goals.

The Future of the Space Coast



NASA Opportunities

NASA Jobs Web site (nasajobs.nasa.gov)
NASA Internships (intern.nasa.gov)

NASA + University collaborative projects
X-Hab (nasa.gov/exploration/technology/deep_space_habitat/xhab)

References

- Progress in Defining the Deep Space Gateway and Transport Plan https://www.nasa.gov/sites/default/files/atoms/files/nss_chart_v23.pdf
- Exploration Architecture Planning https://www.nasa.gov/sites/default/files/atoms/files/march_2017_nac_charts_architecturejmf_rev_3.pdf
- KSC Master Plan https://masterplan.ksc.nasa.gov/HTMLAssets/NASAKSCExecSummNew.pdf
- KSC Future Use Plan https://masterplan.ksc.nasa.gov/-/media/Master%20Plan/Future%20Land%20Use%20Map%20Stretched_Final.ashx